

U.S. Serial Number: 10/771,919
Reply to final Office Action mailed June 8 2009
P2003J016

7 of 12

REMARKS

Claim 10 is amended to further clarify the nature of the invention. New claim 18 is also added. Support for the amendments can be found, for example, at paragraph 0029 of the specification as filed.

Claim 1 is amended to further clarify the nature of the invention. Support for the amendment can be found, for example, at paragraphs 0028 – 0030.

No new matter is introduced.

Claim 10

The rejection of Claims 10 – 17 under 35 USC 103(a) as being unpatentable over U.S. 6,767,530 (Kobayashi) in view of U.S. 2,556,835 (Barr), U.S. 6,299,994 (Towler, U.S. 4,240,805 (Sederquist) and either U.S. 5,763,114 (Khandkar) or U.S. 6,969,506 (Tonkavich), optionally further in view of U.S. 6,338,239 (Hirata) is respectfully traversed. The cited references fail to describe or suggest all elements of the claimed invention.

Claim 10 as amended requires that a mixture of a fuel and an oxygen-containing gas are introduced into a second end of a second zone. This element is not described or suggested by the cited references. Additionally, any effort to modify the cited references to arrive at this element would require elimination of a critical feature of a reference.

As noted in the Office Action, Kobayashi does not describe or suggest the above feature. Although Kobayashi describes numerous variations for how to construct a hydrogen producing apparatus, in each variation Kobayashi explicitly combines the fuel and hydrogen only at the furnace 15. Neither of the regenerative

U.S. Serial Number: 10/771,919
Reply to final Office Action mailed June 8 2009
P2003J016

8 of 12

beds 8 or 21 that are upstream of furnace 15 during a regeneration cycle are exposed to a mixture of fuel and oxygen.

Kobayashi states that in a special alternative embodiment that is not preferred, the fuel and hydrogen can be mixed in the reforming reactor 6. Reforming reactor 6 in Kobayashi performs a function similar to that of the first zone of the claimed invention. Thus, even this non-preferred alternative in Kobayashi fails to describe or suggest this element. (Note: Mixing the fuel and oxygen in reforming reactor 6 is not preferred based on Kobayashi's statement at Col. 3, line 31 that it is preferred not to use a steam reforming catalyst. Kobayashi states at Col. 5, lines 45 – 58 that combining the fuel and oxygen is only possible when steam reforming catalyst is in reactor 6.)

In order to overcome the above deficiency, the Office Action notes the Sederquist reference. However, Applicants disagree with the characterization of Sederquist provided in the Office Action.

In FIGs. 1 and 2 of Sederquist, a reactor with three zones is shown. Zone 1 is described as including inert material. Zone 2 is described as including catalyst and inert material. Zone 3 is described as including inert material, or optionally as also including a water gas shift catalyst.

During a reforming process, gas in Sederquist passes from the Zone 1 to Zone 2 to Zone 3. Sederquist explicitly notes that a) no reforming occurs in the Zone 1, and b) Zone 1 contains no reforming catalyst. Thus, when comparing the teaching of Sederquist to the claimed invention, the Zone 2 in Sederquist corresponds to the first zone of claim 10. Therefore, in order to satisfy the limitation in claim 10 of introducing a mixture of fuel and an oxygen-containing gas into a second end of a second zone, such a mixture would have to be introduced into Zone 3 of Sederquist.

U.S. Serial Number: 10/771,919
Reply to final Office Action mailed June 8 2009
P2003J016

9 of 12

Sederquist explicitly avoids introducing a mixture of a fuel and an oxygen-containing gas into Zone 3. Instead Sederquist specifically keeps the fuel and oxygen-containing gas separate. (See Col. 7, lines 1 – 12.) One of the key factors in Sederquist is avoiding the possibility of harming reforming catalyst due to performing combustion in the presence of the catalyst. In order to avoid this in the embodiments shown in FIG. 1 or 2, Sederquist only allows both fuel and oxygen to mix in Region 1 of Zone 2, which is downstream of the majority and/or all of the catalyst. (See generally Cols. 7 and 8, and specifically Col. 8, lines 1 – 20.)

(As an aside, Applicants note that FIG. 4 of Sederquist also does not cure the above deficiency. Note that in the embodiment of FIG. 4, Sederquist specifically notes that all combustion occurs in inert catalyst regions 126, 130, and 134. As a result, inert particle zones 130 and 134 will be at a higher temperature than catalyst regions 128 and 132. The second zone of the claimed invention requires that heat is transferred from the reformed product to the packing material of the second zone during reforming. Since zones 130 and 134 are actually at a higher temperature, and since reforming is endothermic, heat will not be transferred from gas to packing material in zones 130 and 134. Thus, these regions cannot correspond to the second zone of the claimed invention.)

Based on the above, both Kobayashi and Sederquist fail to describe or suggest the requirement that a mixture of fuel and an oxygen-containing gas is introduced into the second end of the second zone. Furthermore, any effort to modify Kobayashi and/or Sederquist to arrive at the claimed invention would require contradicting the specific teachings of the references, which is not permissible for forming a prima facie case of obviousness. None of the other cited references can cure this deficiency. Thus, claim 10 and all corresponding dependent claims are allowable for at least this reason.

U.S. Serial Number: 10/771,919
Reply to final Office Action mailed June 8 2009
P2003J016

10 of 12

Claim 1

The rejection of Claims 1 – 9 under 35 USC 103(a) as being unpatentable over U.S. 6,767,530 (Kobayashi) in view of U.S. 2,556,835 (Barr) and either U.S. 5,763,114 (Khandkar) or U.S. 6,969,506 (Tonkavich), optionally further in view of U.S. 6,299,994 (Towler), optionally further in view of U.S. 6,338,239 (Hirata) is respectfully traversed. The cited references fail to describe or suggest all elements of the claims as amended.

Claim 1 as amended requires the combustion of the fuel to occur in a region that is proximate to the interface of the first zone and the second zone that includes at least a portion of the first zone or the second zone. Claim 1 also requires that the regeneratively cooled synthesis gas is subjected to a non-cyclic water-gas shift reaction. This combination of elements is not provided by the cited references, either alone or in combination.

Kobayashi describes various configurations for a hydrogen producing apparatus. In the embodiments shown in FIGs. 1 – 3, a furnace is used as the location for combustion. The furnace used in Kobayashi corresponds to neither the first zone or the second zone of the claimed invention. No description or suggestion is provided that the combustion in these embodiments occurs in any location other than the furnace. Thus, these primary embodiments of Kobayashi do not describe or suggest combustion of fuel in the region required by claim 1.

As noted above, Kobayashi does describe a non-preferred embodiment in connection with the apparatus of FIG. 2 where the furnace can be omitted. In this embodiment, combustion occurs in reforming reactor 6. (As noted above - Mixing the fuel and oxygen in reforming reactor 6 is not preferred based on Kobayashi's statement at Col. 3, line 31 that it is preferred not to use a steam reforming catalyst.

U.S. Serial Number: 10/771,919
Reply to final Office Action mailed June 8 2009
P2003J016

Kobayashi states at Col. 5, lines 45 – 58 that combining the fuel and oxygen is only possible when steam reforming catalyst is in reactor 6.)

However, this non-preferred embodiment associated with FIG. 2 of Kobayashi requires that the fuel gas stream used to capture the heat from beds 21 and 8 is also passed through water gas shift reactor 27. This causes water gas shift reactor 27 to operate in a cyclic mode, which is not permitted by the claimed invention. Modifying Kobayashi to arrive at the claimed invention would require not only selection of a non-preferred embodiment, but further ignoring the explicit teachings of the non-preferred embodiment. Picking and choosing selected features from non-preferred embodiments to arrive at a claimed invention is a hindsight driven analysis, which is not permitted. None of the cited references can cure this deficiency.

For at least the above reasons, reconsideration and withdrawal of the rejection of claim 1 and all corresponding dependent claims is respectfully requested.

As a final note – Applicants also maintain their position that the cited references cannot be operably combined to arrive at the space velocities required by the claimed invention. All pending claims are allowable for at least this additional reason.

12 of 12

U.S. Serial Number: 10/771,919
Reply to final Office Action mailed June 8 2009
P2003J016

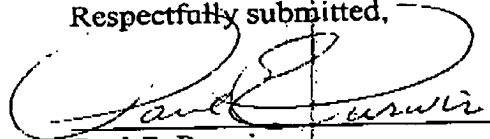
Conclusion

Having demonstrated that all rejections of the claims have been overcome, this application is in condition for allowance. Accordingly, Applicants request early and favorable reconsideration in the form of a Notice of Allowance.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated, since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response. Please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1330.

Respectfully submitted,



Paul E. Purwin
Attorney for Applicant(s)
Registration No. 29,203
Telephone Number: (908) 730-3618
Facsimile Number: (908) 730-3649

☒ Pursuant to 37 CFR 1.34

ExxonMobil Research and Engineering Company
P. O. Box 900
Annandale, New Jersey 08801-0900

PEP:dws:jmw

11/9/09